United States Patent [19]

Fish

[11] **3,847,574**

[45] **Nov. 12, 1974**

[54] **CHARCOAL FILTER ARRANGEMENT**

[75] Inventor: **James F. Fish,** Louisville, Ky.

[73] Assignee: **American Air Filter Company, Inc.,** Louisville, Ky.

[22] Filed: **Mar. 14, 1973**

[21] Appl. No.: **341,126**

[52] **U.S. Cl.** **55/387,** 55/475, 55/476, 55/479, 55/516, 55/519

[51] **Int. Cl.** **B01d 53/14**

[58] **Field of Search** 55/278, 316, 387, 390, 55/475, 476, 478–479, 484–485, 512, 515, 55/516, 519

[56] **References Cited**

UNITED STATES PATENTS

2,108,087	2/1938	Thayer	55/476 X
2,150,930	3/1939	Lassiat	55/476 UX
2,521,060	9/1950	Hallinan	55/484 X
2,526,782	10/1950	Thorpe	55/387 X
2,686,572	8/1954	Cameron et al.	55/476 X
3,246,455	4/1966	Boddy	55/319
3,330,101	7/1967	Murphy	55/484
3,353,339	11/1967	Walter	55/387 X

FOREIGN PATENTS OR APPLICATIONS

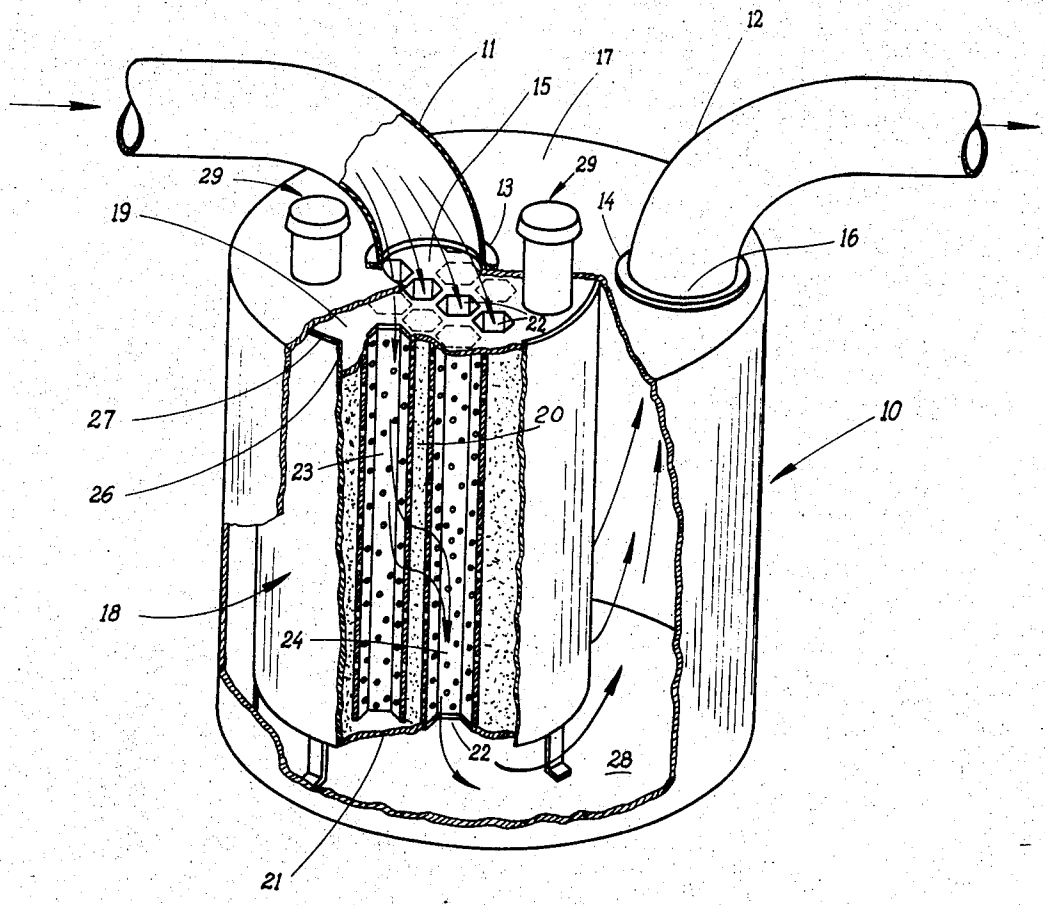
781,602	5/1935	France	55/479
812,635	5/1937	France	55/484

Primary Examiner—Frank W. Lutter
Assistant Examiner—Kathleen J. Prunner

[57] **ABSTRACT**

A carbon filter having an elongated cylindrical housing with a cylindrical filter assembly located axially therein, the cylindrical filter assembly having a plurality of flow-through geometrically shaped axially extending exit and entrance chambers with a loosely packed carbon filter bed therebetween. The entrance and exit chambers are positioned equidistant from each other in alternating fashion, with each flow-through entrance chamber advantageously adjacent at least two flow-through exit chambers and each flow-through exit chamber advantageously adjacent at least two flow-through entrance chambers. The filter assembly additionally comprises a forced-feed charcoal reservoir means maintaining a constant pressure on the loosely packed bed to keep it filled.

3 Claims, 3 Drawing Figures



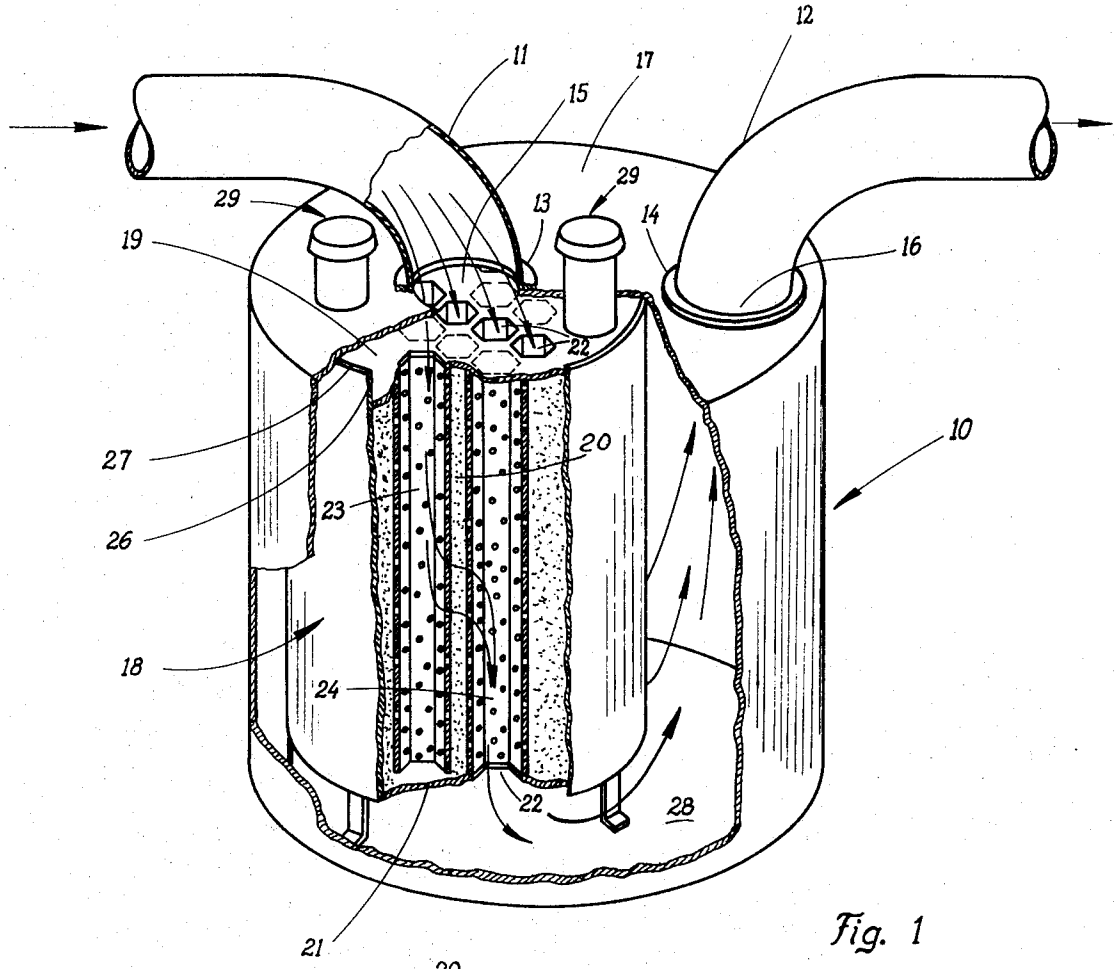

12
11
17
15
29
29
13
14
19
16
22
10
27
20
23
26
18
24
22
28
21

Fig. 1

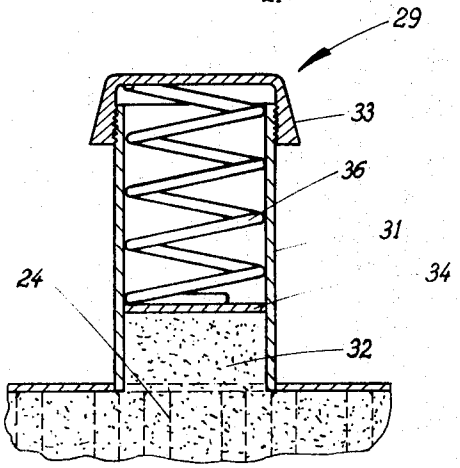

29
33
36
31
34
24
32

Fig. 2

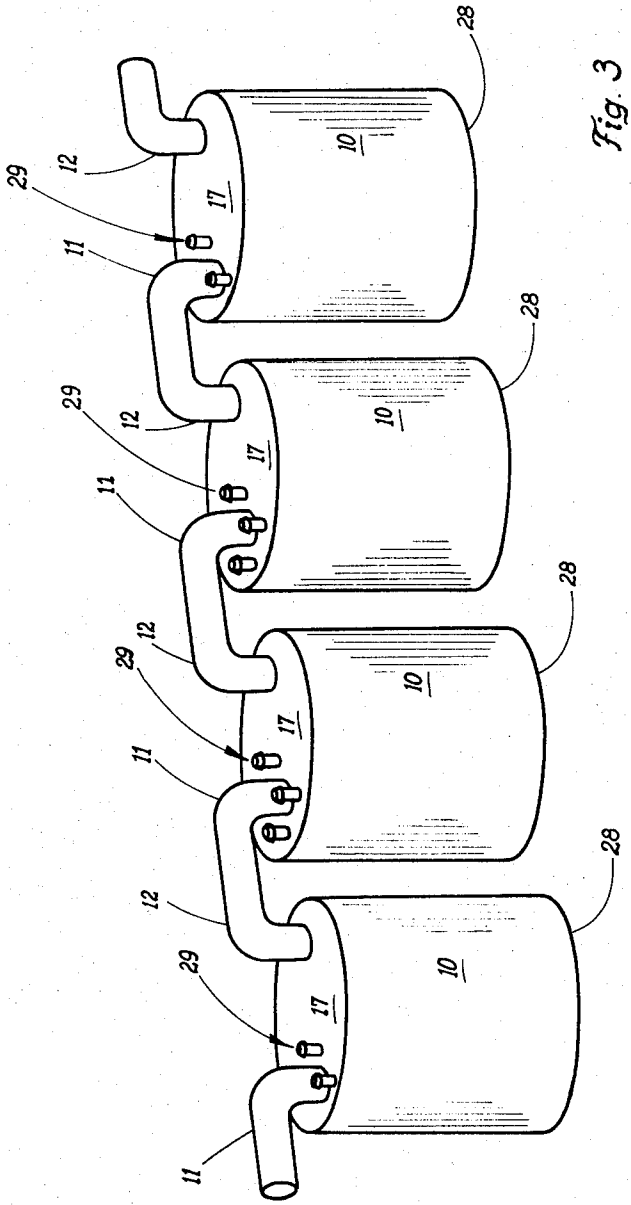


Fig. 3

CHARCOAL FILTER ARRANGEMENT

BACKGROUND OF THE INVENTION

The invention relates to improvements in carbon filter bed arrangements. It more particularly relates to a cylindrical carbon filter containing activated granular charcoal loosely compacted in the form of a bed for treating gases. Typically, gas purification methods of commercial value must be capable of treating gases moving at relatively high gas velocities. Due to the high velocities encountered it may be necessary to connect a plurality of purifying apparatuses in series, one after the other in order to obtain a sufficiently long time of treatment to effect the purification. The high velocities used in such gas purification have the advantage of a considerably better exchange of material so that in principal the required time of treatment decreases. The gas velocity which is encountered in each case influences the grain size of the purifying material, with this grain size determining ultimately the number of apparatuses to be connected in series. However, the prior art systems do not provide a filter assembly having a large surface area filter bed being of the size needed to accommodate high velocity gas flow rates and yet free from concomitant problems of settling and particle attrition. Also the prior art systems are typically so cumbersome that they cannot be used in location where space is limited. The present invention is a straightforward, inexpensive, readily constructed and easily maintained apparatus which solves the above prior art problems.

SUMMARY OF THE INVENTION

The present invention provides a filter arrangement including a cylindrical housing and a cylindrical filter arrangement axially located therein, which contains a particulate carbon filter bed of uniform thickness and means to maintain said bed in a condition free from adverse effects of settling or particle attrition. More specifically, the present invention provides a filter arrangement wherein a large surface area carbon filter bed is maintained in filled condition by a forced-feed carbon particle reservoir in flow communication with the bed. The present invention provides a carbon filter for removing gaseous contaminants comprising: a flow-through housing having inlet and outlet connections in flow communication with the interior thereof; a filter assembly, located within said flow-through housing having at least one geometrically shaped flow-through axially extending exit chamber and at least one geometrically shaped flow-through axially extending entrance chamber, said entrance chamber being in flow communication with said inlet connection and said exit chamber being in flow communication with said outlet connection; granulated activated charcoal disposed within the space between said entrance chamber and said exit chamber to form a loosely packed granular charcoal filter bed of uniform flow-through thickness; and, forced-feed charcoal reservoir means containing flowable particulate activated charcoal in flow communication with said charcoal filter bed to keep said bed continuously filled.

The apparatus of this invention is found to be particularly useful in the field of nuclear containment where carbon filters are typically used to remove nuclear contaminants from gas streams.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of the carbon filter having cutaway sections showing specific details of its construction.

FIG. **2** is a cross-sectional view of the forced-feed charcoal reservoir means of FIG. **1.**

FIG. **3** is a schematic view showing a plurality of carbon filters of FIG. **1** connected in series.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** shows a housing **10** having top **17,** bottom **28** and an inlet **11** and an outlet **12** in flow communication with the interior of the housing. Inlet **11** and outlet **12** have flange members **13** and **14,** respectively, which are attached to top **17** of housing **10.** These flange members are adapted to be easily affixed to the peripheral edges of openings **15** and **16** of top **17** in such a manner that they are readily disconnected for removal to facilitate either removal of top **17** and replacement of cylindrical filter assembly **18** or replacement of the entire housing **10** with a housing having a new or regenerated cylindrical filter assembly therein.

Cylindrical filter assembly **18** has upper and lower ends **19** and **21,** respectively. Upper and lower ends **19** and **21** include openings **22** of hexagonal cross section arranged in spaced rows extending across the breadth of the ends. These openings **22** form the mouth portions of a plurality of flow-through axially extending entrance and exit chambers **23** and **24,** respectively, of hexagonal cross section. Each of openings **22** in upper end **19** is connected in flow communication with a flow-through axially extending entrance chamber **23** having a hexagon shaped cross section. Each of openings **22** in lower end **21** is connected in flow communications with a flow-through axially extending exit chamber **24** having a hexagon shaped cross section. The entrance and exit chambers are positioned equidistant from each other in alternating fashion and secured to ends **19** and **21** by welding, gluing or the like, such that each flow through entrance chamber **23** circumscribes an aperture **22** in ends **19** and terminates at a solid portion of end **21** and each exit chamber circumscribes an aperture **22** in end **21** and terminates at a solid portion of end **19.** Advantageously, each flow-through entrance chamber is adjacent at least two flow through exit chambers and each flow through exit chamber is adjacent at least two flow through entrance chambers. Granular activated charcoal occupies the space between the entrance and exit chambers to form a loosely packed filter bed as will be disclosed hereinafter.

Cylindrical filter assembly **18** further comprises peripheral skirt **26,** which can be merely an extension of filter assembly **18** which projects beyond upper end **19.** The uppermost peripheral edge **27** of peripheral skirt **26** is sealingly attached to the underside of top **17** in such a manner that it circumscribes opening **15,** thereby forming an inlet plenum above upper end **19.** Assembly **18** including entrance and exit chambers **23** and **24,** respectively, may be fabricated from any one of a number of suitable materials known in the art, and advantageously, a lightweight thin gauge aluminum, steel or even wood, polymeric resinous materials, or paperboard, or other suitable materials can be utilized.

It should be noted from FIG. **1** that cylindrical filter assembly **18** does not extend axially all the way to bottom **28** of cylindrical housing **10.** This is of course necessarily the case so that treated gas may be withdrawn through exit chambers **24** and out through outlet **12.** Such an arrangement whereby peripheral skirt **26** is sealed to the underside of top **17** to form an inlet plenum chamber provides for the remainder of the space inside housing **10** to serve as an outlet plenum chamber, it being in flow communication with outlet **12.**

Alternative to the arrangement of entrance and exit chambers shown in the drawing a filter arrangement constructed in accordance with U.S. Pat. No. 3,330,101 (incorporated herein by reference) would be used within assembly **18** without destroying the concept of a filter assembly including a housing within a housing and a positive feed bed filter arrangement.

One advantageous feature of the filter assembly shown in FIG. **1** is the forced-feed charcoal reservoir means **29** shown in FIG. **2.** Forced-feed charcoal rservoir means **29** comprises cylindrical container **31,** filled with flowable particulate activated charcoal **32,** and a removable screw cap **33.** Inside cylindrical container **31** is flat solid plate means **34** concentrically positioned contacting activated charcoal **32.** Also, positioned concentrically within cylindrical container **31** is spring means **36** which abutts screw cap **33** and biases plate means **34** against activated charcoal **32,** thereby creating a constant pressure on the activated charcoal which comprises carbon filter bed **20** between entrance chambers **23** and exit chambers **24.** It should be noted that forced-feed charcoal reservoir means **29** extend through cylindrical housing **10** so that access may be had to screw cap **33** from the exterior of housing **10.** Such an arrangement allows screw cap **33,** spring means **36** and plate means **34** to be removed and more flowable particulate activated charcoal to be added at periodic intervals. Such an arrangement thereby insures that the carbon filter apparatus will always have an ample supply of carbon filtering material. This feature becomes more significant when it is recognized that operational vibrations cause the carbon material to settle as well as abraid to form smaller particles, which in each instance opens voids in the filter bed. Forced-feed charcoal reservoir means **29** are shown only at one end of cylindrical filter assembly **18,** however it is understood that under certain circumstances it may be desirable, if not necessary, to provide such reservoir means at both ends of the filter assembly. Provision of course would be made for access to all of the screw caps **33.** Another advantageous feature of the forced-feed charcoal reservoir means **29** is that they exert pressure upon the carbon filter bed irrespective of the bed's orientation. Thus, should the carbon filter assembly of this invention be used in aircraft or other like applications forced-feed charcoal reservoir means **29** would insure a closely packed charcoal filter bed. It should further be noted that a cylindrical filter assembly could be manufactured in sections with each section being provided with a forced-feed charcoal reservoir means to insure a homogenously packed bed throughout its entire length.

It should be noted that if circumstances so warrant, a much smaller filter could be fabricated wherein top **17** would have a diameter equal to the diameter of peripheral skirt **26** and then a second peripheral skirt could be attached to cylindrical filter assembly **18** at its lower end, such peripheral skirt being identical to the peripheral skirt **26.** This second peripheral skirt would then be sealingly attached to bottom **28,** which would be of a diameter equal to the diameter of the second peripheral skirt. Outlet **12** would then be attached in flow communication with bottom **28** in a manner such as to provide a straight through filter assembly of much smaller diameter than the filter assembly shown in FIG. **1.**

FIG. **3** shows a plurality of housings **10** containing cylindrical filter assemblies connected in flow communication in series. It should be noted that in such an arrangement it is possible to utilize various forms of carbon filters each having a specific function. For example, it is possible in the first of the filter arrangements to have a filter wherein large granular particles are employed while in the second smaller particles are employed and in the third the carbon particles are treated with, for example, an iodine solution followed perhaps by a fourth wherein the carbon particles are treated with still another solution.

Having thus described the invention, what is claimed is:

1. A carbon filter for removing gaseous contaminants comprising: a flow-through housing having inlet and outlet connections in flow communication with the interior thereof;

a filter assembly, located within said flow-through housing having a plurality of geometrically shaped flow-through axially extending exit chambers and a plurality of geometrically shaped flow-through axially extending entrance chambers, said entrance chambers being in flow communication with said inlet connection and said exit chambers being in flow communication with said outlet connection, said filter assembly being cylindrical and comprises said plurality of flow-through axially extending exit and entrance chambers positioned equidistant from each other in alternating fashion such that each flow-through entrance chamber is adjacent at least two flow-through exit chambers and each flow exit chamber is adjacent at least two flow-through entrance chambers, said cylindrical filter assembly located within said cylindrical housing additionally comprises a peripheral skirt extending from one end thereof which is sealingly attached to one end of said housing, circumscribing said inlet connection of said housing, to form an inlet plenum in flow communication with said connection and the entrance chamber of said filter assembly;

granulated activated charcoal disposed within the space between said entrance chambers and said exit chambers to form a loosely packed granular charcoal filter bed of uniform flow-through thickness; and

forced-feed charcoal reservoir means extending through the walls of said housing to allow access to said reservoir from outside said housing, said reservoir means containing flowable particulate activated charcoal in flow communication with said charcoal filter bed to keep said bed continuously filled, said forced feed charcoal reservoir means comprises an elongated cylindrical container filled with flowable particulate activated charcoal in flow communication with the filter bed of said filter assembly, said cylindrical container having a remov-

able screw cap, flat solid plate means concentrically positioned therein contactijng said flowable particulate activated charcoal, and spring means abutting said screw cap and biasing said solid plate means against said charcoal in said reservoir to keep constant pressure on said charcoal filter bed of the filter assembly.

2. The apparatus of claim **1** where said inlet and outlet connections are positioned on the same end of said housing to allow two or more housings to be connected in series.

3. The apparatus of claim **1** wherein said axially extending exit and entrance chambers are of hexagonal cross section.

* * * * *